

Automated External Defibrillator (AED) Device Operation

The Automated External Defibrillator (AED) is a user-friendly medical device designed to analyze the heart's rhythm and deliver an electrical shock (defibrillation) when indicated, with the goal of restoring an effective cardiac rhythm during sudden cardiac arrest (SCA). When encountering an unresponsive person and establishing pulselessness, cardiopulmonary resuscitation (CPR) should commence while another responder obtains and operates the AED. AEDs are designed to be used by individuals with limited training. Survival rates from SCA are significantly higher when AEDs are used promptly to restore a normal cardiac rhythm.

There are two types of AEDs, semi-automated and fully automated. Both types have voice instructions to help guide the untrained responder through the rescue process. Semi-automated defibrillators analyze the heart's rhythm, and if an abnormal rhythm is detected that needs a defibrillation shock, the device prompts the user through voice commands to press a button to deliver the shock. Fully automated defibrillators also analyze the heart's rhythm, but if a shock is indicated, the device will deliver it without any user input. AEDs can be found in public parks, airports, train stations, community centers, schools, government buildings, stadiums, and other public locations.

Purpose:

The primary purpose of an AED is immediate treatment of ventricular fibrillation (VF) or pulseless ventricular tachycardia (pVT). The AED provides a critical, time-sensitive intervention by identifying VF or pVT, and delivering a defibrillation shock to restore normal sinus rhythm and spontaneous circulation.

Indications:

An AED is indicated for use in individuals who are unresponsive and pulseless as a result of sudden cardiac arrest.

An AED is not indicated for individuals experiencing an acute myocardial infarction (MI) or “heart attack”. In acute MI, the person is typically still conscious, breathing, and experiencing chest pain, diaphoresis, nausea, epigastric pain, or arm pain. Acute MI can precipitate VF or pVT, so it is prudent to call 911 and find the location of the nearest AED in case of deterioration to SCA.

Operation:

AEDs are designed for ease of use by both medical professionals and trained lay responders. Ideally, a second rescuer is simultaneously performing CPR and delivering chest compressions. The typical operation involves the following steps:

1. **Power On:** Turn on the AED. Some models automatically power on when the lid is opened. The device will then provide clear voice prompts and visual cues.
2. **Attach Pads:** Expose the patient's bare chest. Apply two electrode pads to specific locations on the patient's chest as indicated by diagrams on the pads themselves or the AED unit. Standard adult pad placement involves one pad below the right collarbone and the other near the left armpit on the lower ribcage. For pediatric patients (usually less than 9 years of age), an anterior-posterior placement may be preferred. Ensure good skin contact; if excessive chest hair is present, it may need to be quickly trimmed or shaved to ensure adhesion. Dry the chest thoroughly if wet.
3. **Analyze Rhythm:** Once the pads are correctly attached, the AED will instruct all rescuers to "stand clear" and will analyze the patient's heart rhythm. During this analysis, CPR must stop, and no one should touch the patient to avoid interfering with the ECG signal and to ensure rescuer safety if a shock is delivered.
4. **Deliver Shock (if indicated):**
 - If a shockable rhythm (V-fib or pVT) is detected, the AED will announce "shock advised" and begin charging.
 - The AED will then instruct the user to "clear" the patient again and press the "shock" button. It's imperative to visually confirm that no one is touching the patient before delivering the shock.
 - If a non-shockable rhythm (e.g., asystole or normal sinus rhythm) is detected, the AED will advise "no shock advised" and prompt the rescuer to continue CPR.
5. **Resume CPR:** Immediately after the shock (or if no shock was advised), resume chest compressions. Most AEDs provide a metronome or voice prompts to guide the rate and depth of compressions for two minutes.
6. **Re-analyze:** After two minutes of CPR, the AED will prompt another rhythm analysis, and the cycle repeats until emergency medical services (EMS) arrive and take over, or the patient regains consciousness and normal breathing.

Special Considerations and Contraindications:

While AEDs are generally safe and effective when used appropriately, nurses should be aware of specific considerations:

- **Do Not Resuscitate (DNR) Orders:** If a patient has a valid DNR order, an AED should not be used. However, sudden cardiac arrest often occurs in a community setting without a family member present to clarify advanced directives or code status. When in doubt, it is imperative to intervene.
- **Traumatic Arrest:** Generally, AEDs are not indicated for cardiac arrest secondary to severe trauma, unless there's a strong suspicion of a medical cause for the arrest in a trauma patient. Massive internal or external hemorrhage leads to pulseless electrical activity (PEA) or asystole, which are not shockable rhythms.
- **Wet Environment:** The patient should be moved to a dry area and their chest dried before applying pads and delivering a shock to prevent arcing and ensure effective energy delivery.
- **Implanted Devices:** Avoid placing AED pads directly over implanted pacemakers or implantable cardioverter-defibrillators (ICDs). Position the pad at least 1 inch (2.5 cm) away from the device.
- **Medication Patches:** Remove any transdermal medication patches (e.g., nitroglycerin, nicotine) from the chest area and wipe the skin clean before applying AED pads, as they can block energy delivery or cause burns.
- **Movement:** Do not use an AED in a moving vehicle.
- **Children under 1 year:** Manual defibrillators are preferred for infants under 1 year of age. If a manual defibrillator is not available, attenuated pediatric pads or even adult pads (if no pediatric pads are available) may be considered, but with caution and understanding of the energy delivered.
- **Flammable Vapors:** Avoid using an AED in the presence of flammable gases or liquids, as a spark could ignite them.

The single most important factor in improving outcomes from sudden cardiac arrest is rapid delivery of an external electric shock to reset the cardiac rhythm and restore spontaneous circulation. The AED is a vital tool for the immediate treatment of sudden cardiac arrest due to

VF or pVT. The intuitive design of the AED allows for rapid deployment by the lay rescuer, maximizing the chances of survival.

References

Cabanas, J. et al. (2025). American Heart Association Automated External Defibrillator Symposium: Summary and Recommendations. *Journal of the American Heart Association*.

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